In the Claims

Applicant has submitted a new complete claim set showing marked up claims with insertions indicated by underlining and deletions indicated by strikeouts and/or double bracketing.

Please amend pending claims 77, 89, 91-92, 97, 108, 139, 140, 141, and 147 as noted below. Please add claims 148-156.

1 – 76 (Canceled)

77. (Currently Amended) A method of forming a masking pattern on a surface, said method comprising the steps of:

using the technique of drop-on-demand printing to deposit from droplet deposition apparatus a plurality of droplets of deposition material on to a surface ~~to form a masking pattern~~, said droplets passing through an operating zone located between the deposition apparatus and the surface, and said droplets being deposited so as to enable coalescence of one such droplet with at least one other such droplet on said surface, and thus to form said masking pattern;

generating electromagnetic radiation; and

~~locally~~ exposing said deposition material ~~the operating zone~~ to said electromagnetic radiation ~~so as to control coalescence of droplets on the surface, thereby~~ in the operating zone,

wherein said electromagnetic radiation is generated in such a way as to change a fluid property of said deposition material so as to control said coalescence and thus to control~~ling~~ the solidity of the masking pattern.

78. (Original) A method according to Claim 77, wherein the formation of the masking pattern is controlled so that the masking pattern has predetermined structural properties.

79. (Original) A method according to Claim 77, wherein the operating zone extends from the deposition apparatus to the surface.

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80. (Original) A method according to Claim 77, wherein relative movement is effected between the deposition apparatus and the surface so as to move said operating zone across the surface during formation of the masking pattern.

81. (Original) A method according to Claim 77, wherein the local environment of the operating zone is controlled so as to control the coalescence of the droplets on the surface.

82. (Original) A method according to Claim 77, wherein the local environment of the operating zone is controlled so as to control the spreading of the droplets on the surface.

83. (Original) A method according to Claim 77, wherein the local environment of the operating zone is controlled so as to control placement of the droplets on the surface.

84. (Original) A method according to Claim 77, wherein the local temperature of the operating zone is controlled so as to control the rate of solidification of the droplets on the surface.

85. (Original) A method according to Claim 77, wherein the local atmosphere of the operating zone is controlled.

86. (Original) A method according to Claim 85, wherein an at least partial vacuum is generated in the operating zone so as to substantially avoid contamination of the droplets during passage from the deposition apparatus to the surface.

87. (Original) A method according to Claim 85, wherein a pressure differential extending between the deposition apparatus and the surface is established in the operating zone.

88. (Original) A method according to Claim 85, wherein an inert or reactive gas is introduced into the operating zone during droplet deposition.

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89. (Currently Amended) A method according to Claim 77, wherein the duration of the ~~local~~ exposure of the operating zone to electromagnetic radiation is controlled so as to control the spreading of the droplets on the surface, thereby controlling the resultant shape of the masking pattern.

90. (Original) A method according to Claim 77, wherein the intensity of electromagnetic radiation is controlled so as to control the spreading of the droplets on the surface, thereby controlling the resultant shape of the masking pattern.

91. (Currently Amended) A method according to Claim 77, wherein the operating zone extends to the surface, and ~~local~~ exposure of the operating zone to electromagnetic radiation is carried out subsequent to the deposition of droplets passing through the operating zone.

92. (Currently Amended) A method according to Claim 91, wherein the time period between the deposition of droplets on the surface and said ~~local~~ exposure is controlled so as to control spreading of the droplets on the surface.

93. (Original) A method according to Claim 92, wherein said time period is in the range from 1 to 2000 ms.

94. (Original) A method according to Claim 93, wherein said time period is in the range from 50 to 300 ms.

95. (Original) A method according to Claim 77, wherein said electromagnetic radiation is emitted from a source integral with said deposition apparatus.

96. (Original) A method according to Claim 95, wherein said electromagnetic radiation is emitted from a plurality of sources spaced along the deposition apparatus.

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97. (Currently Amended) A method according to Claim 77, wherein the electromagnetic radiation comprises at least one of ultra violet, visible light, infra red, and microwaves ~~and alpha-particles~~.

98. (Original) A method according to Claim 77, wherein multiple wavelengths of electromagnetic radiation are co-incident sequentially or in parallel on the deposited droplets.

99. (Original) A method according to Claim 77, wherein the electromagnetic radiation is emitted from at least one light emitting diode.

100. (Original) A method according to Claim 99, wherein the electromagnetic radiation is emitted from an independently addressable array of light emitting diodes.

101. (Original) A method according to Claim 77, wherein the electromagnetic radiation is emitted from a semiconductor quantum-well solid state laser.

102. (Original) A method according to Claim 101, wherein the electromagnetic radiation is emitted from an independently addressable array of semiconductor quantum-well solid state lasers.

103. (Original) A method according to Claim 77, wherein the electromagnetic radiation is emitted from at least one light emitting polymer.

104. (Original) A method according to Claim 103, wherein the electromagnetic radiation emitted from said light emitting polymer is filtered to select a particular wavelength of electromagnetic radiation.

105. (Original) A method according to Claim 77, wherein the electromagnetic radiation is emitted from a microwave initiated gaseous discharge radiation source.

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106. (Original) A method according to Claim 77, wherein the electromagnetic radiation is emitted from a plurality of optical fibres.

107. (Original) A method according to Claim 77, wherein the electromagnetic radiation emitted is focused on the droplets.

108. (Currently Amended) A method according to Claim 77, wherein, subsequent to the ~~local~~ exposure of the operating zone to electromagnetic radiation, the deposited masking pattern is fully exposed to electromagnetic radiation so as to ensure that the deposited droplets are cured.

109. (Original) A method according to Claim 77, wherein the distance between the deposition apparatus and the surface is controlled during droplet deposition so as to control the time taken for a droplet to pass from the deposition apparatus on to the surface.

110. (Original) A method according to Claim 109, wherein said distance is in the range from 0.5 to 2 mm.

111. (Original) A method according to Claim 110, wherein said distance is in the range from 0.75 to 1.25 mm.

112. (Original) A method according to Claim 77, wherein the deposited masking pattern is imaged using imaging apparatus integral with the deposition apparatus.

113. (Original) A method according to Claim 77, comprising the step of controlling the surface energy of the surface prior to droplet deposition.

114. (Original) A method according to Claim 113, wherein the surface is subjected to at least one of abrasion, polishing, ozone treatment, plasma exposure and surface coating prior to droplet deposition.

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115. (Original) A method according to Claim 77, wherein the droplets are deposited from a droplet deposition printhead comprising a deposition chamber for housing said deposition material, an outlet nozzle in fluid communication with said deposition chamber, and means for ejecting droplets of deposition material from said deposition chamber through said outlet nozzle.

116. (Original) A method according to Claim 115, wherein the droplets are deposited from a plurality of said printheads.

117. (Original) A method according to Claim 116, wherein the masking pattern is formed from a plurality of deposition materials, each deposition material being deposited from respective deposition printhead.

118. (Original) A method according to Claim 115, wherein the outlet nozzle is selectively covered to substantially prevent entry of electromagnetic radiation into the deposition printhead.

119. (Original) A method according to Claim 115, wherein said nozzle is cleaned after ejection of a droplet from said deposition chamber.

120. (Original) A method according to Claim 115, wherein said outlet nozzle is selectively covered by a nozzle shutter, said shutter comprising means for cleaning said nozzle.

121. (Original) A method according to Claim 120, wherein said outlet nozzle is cleaned by a movable wiper blade attached to said nozzle shutter.

122. (Original) A method according to Claim 120, wherein residual deposition material removed from said nozzle by said cleaning means is transferred to a reservoir housed with said deposition printhead.

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123. (Original) A method according to Claim 77, wherein the surface is disposed on a flexible sheet connected between two reels, said reels being rotated to move the surface relative to the deposition apparatus.

124. (Original) A method according to Claim 77, comprising the step of at least partially removing said deposited masking pattern.

125. (Original) A method according to Claim 77, wherein said masking pattern is a three-dimensional masking pattern.

126. (Original) A method according to Claim 125, wherein said masking pattern comprises a plurality of layers of deposition material, said layers being sequentially deposited on said surface.

127. (Original) A method according to Claim 126, wherein each layer has a respective shape.

128. (Original) A method according to Claim 125, wherein said masking pattern is formed from a multiplicity of droplets deposited at a plurality of deposition sites on the surface, droplets being deposited at each of said sites in turn.

129. (Original) A method according to Claim 77, wherein said masking pattern comprises a solder reflow mask.

130. (Original) A method according to Claim 129, wherein said mask is formed from one of silicone, polyimide, polytetrafluoroethylene and epoxy.

131. (Original) A method according to Claim 77, wherein said masking pattern is an etching mask.

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132. (Original) A method according to Claim 131, wherein said etching mask is formed from an organic-inorganic fluid.

133. (Original) A method according to Claim 131, wherein said etching mask is formed from one of epoxy, polycarbonate, silicon, polytetrafluoroethylene, polychlorotrifluoroethylene, polyimide, polyisoprene and polypropylenepolystyrene.

134. (Original) A method according to Claim 77, wherein said masking pattern is an electrically conductive mask.

135. (Original) A method according to Claim 134, wherein said mask is formed from one of carbon-based and metal acetate-based material.

136. (Original) A method according to Claim 77, wherein said masking pattern is a decorative masking pattern.

137. (Original) A method according to Claim 77, wherein said masking pattern is an ion implantation mask.

138. (Original) A method according to Claim 77, wherein said masking pattern is a confinement well mask.

139. (Currently Amended) A method of forming a spacer pattern on a surface, said method comprising the steps of:

using the technique of drop-on-demand printing to deposit from droplet deposition apparatus a plurality of droplets of deposition material on to a surface ~~to form a spacer pattern~~, said droplets passing though an operating zone located between the deposition apparatus and the surface, and said droplets being deposited so as to enable coalescence of one such droplet with at least one other such droplet on said surface, and thus to form said spacer pattern;

generating electromagnet radiation; and

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~~locally~~ exposing said deposition material ~~the operating zone~~ to said electromagnetic radiation ~~so as to control coalescence of droplets on the surface, thereby~~ in the operating zone,

wherein said electromagnetic radiation is generated in such a way as to change a fluid property of said deposition material so as to control said coalescence and thus to control~~ling~~ the solidity of the spacer pattern.

140. (Currently Amended) A method of forming a circuit pattern on a circuit board, said method comprising the steps of:

using the technique of drop-on-demand printing to deposit from droplet deposition apparatus a plurality of droplets of deposition material on to said circuit board to at least partially fill via holes formed in the circuit board, said droplets passing through an operating zone located between the deposition apparatus and the surface, and said droplets being deposited so as to enable coalescence of one such droplet with at least one other such droplet, and thus to fill said via holes;

generating electromagnetic radiation; and

~~locally~~ exposing said deposition material ~~the operating zone~~ to said electromagnetic radiation ~~so as to control coalescence of droplets on the circuit board, thereby~~ in the operating zone,

wherein said electromagnetic radiation is generated in such a way as to change a fluid property of said deposition material so as to control said coalescence and thus to controlling the filling of the via holes.

141. (Currently Amended) A method of forming a relief pattern on a surface, said method comprising the steps of

selectively irradiating a charged roller to selectively remove the charge on portions of the roller;

using the technique of drop-on-demand printing to deposit from droplet deposition apparatus a plurality of droplets of deposition material on to the charged portions of the roller, said droplets passing through an operating zone located between the deposition apparatus and the roller, and said droplets being deposited so as to enable coalescence of one such droplet with at least one other such droplet on said charged portions of said roller;

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generating electromagnetic radiation;

~~locally~~ exposing said deposition material ~~the operating zone~~ to said electromagnetic radiation ~~so as to control coalescence of droplets on the charged portions of the roller, thereby controlling the structure of the pattern formed on the roller~~ in the operating zone; and

transferring the deposited material from the roller on to a surface to form a relief pattern on said surface,

wherein said electromagnetic radiation is generated in such a way as to change a fluid property of said deposition material so as to control said coalescence and thus to control the structure of the pattern formed on the roller.

142. (Original) A method according to Claim 141, wherein the relief pattern formed on the surface is subsequently heated to effect material coalescence.

143. (Original) A method according to Claim 141, wherein the relief pattern formed on the surface is subsequently subjected to radiation curing to effect material coalescence.

144. (Original) A method according to Claim 141, wherein the relief pattern comprises an organic electrode.

145. (Original) A method according to Claim 141, wherein said relief pattern comprises an opto-electronic device.

146. (Original) A method according to Claim 141, wherein the relief pattern comprises a masking pattern.

147. (Currently Amended) Droplet deposition apparatus comprising a deposition chamber for housing deposition material, an outlet nozzle in fluid communication with said deposition chamber, means for ejecting droplets of deposition material on demand from said deposition chamber through said outlet nozzle on to a surface, means for defining an operating zone through which droplets pass between the outlet nozzle and the surface, means for generating electromagnetic radiation, and means for ~~locally~~ exposing the operating zone to said

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electromagnetic radiation, wherein said means for generating electromagnetic radiation is adapted to generate said electromagnetic radiation in such a way as to change a fluid property of said deposition material so as to control coalescence of droplets on the surface.

148. (New) A method according to Claim 77, wherein said fluid property comprises at least one of rheology, chemical cross-linking, and viscosity.

149. (New) A method according to Claim 77, wherein said exposure to electromagnetic radiation occurs at least partially in-flight.

150. (New) A method according to Claim 77, wherein spreading of said deposition material on the surface is arrested within about 1 millisecond of deposition on said surface.

151. (New) A method according to Claim 77, wherein said coalescence occurs within 10 microseconds of deposition of said one such droplet.

152. (New) A method according to Claim 95, wherein said electromagnetic radiation is emitted from a source integrated with a printhead.

153. (New) A method according to Claim 101, wherein said laser is integrated with a printhead.

154. (New) A method of forming a circuit pattern on a circuit board, said method comprising the steps of:

using drop-on-demand printing to deposit from a droplet deposition apparatus at least one droplet of deposition material on to said circuit board to at least partially fill a via hole formed in the circuit board, said at least one droplet passing through an operating zone located between the deposition apparatus and the surface;

generating electromagnetic radiation; and

exposing said deposition material to said electromagnetic radiation in the operating zone,

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wherein said electromagnetic radiation is generated in such a way as to change a fluid property of said deposition material so as to control surface tension of said at least one droplet on said circuit board and thus to control the filling of the via hole.

155. (New) Droplet deposition apparatus according to Claim 147 comprising a printhead, wherein said means for exposing the operating zone to said electromagnetic radiation is integrated with said printhead.

156. (New) Droplet deposition apparatus according to Claim 147, wherein said means for exposing the operating zone to said electromagnetic radiation comprises a semiconductor quantum-well solid state laser.

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